UNITED STATES DEPARTMENT OF AGRICULTURE

SYLLABUS 21

Contribution from the States Relations Service, A. C. TRUE, Director
In cooperation with the Bureau of Plant Industry, W. A. TAYLOR, Chief

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ILLUSTRATED LECTURE ON CORN PRODUCTION

By

C. P. HARTLEY, Physiologist in Charge of Corn Investigations, Bureau of Plant Industry, and H. B. HENDRICK, Assistant in Agricultural Education, States Relations Service

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SYLLABUS 21—ILLUSTRATED LECTURE ON CORN PRODUCTION.[1]

By C. P. HARTLEY, *Physiologist in Charge of Corn Investigations, Bureau of Plant Industry*, and H. B. HENDRICK, *Assistant in Agricultural Education, States Relations Service.*

INTRODUCTION.

View. For no 10-year period has the corn yield of the United States exceeded 28 bushels per acre. No State has averaged for any year over 54 bushels per acre, yet in practically every section of the United States yields of more than 100 bushels have been produced. As States and as a Nation too much land is being used and much more labor is being performed in producing the corn crop than is necessary. The demand controls the quantity that should be grown. To meet demands the producers of the United States during the years previous to 1910 averaged in round numbers 2,500,000,000 bushels of corn yearly. In producing this quantity a little more than 95,000,000 acres have yearly been devoted to corn growing.

1 The possibility of doubling our acre yield of corn is so good and its accomplishment of such tremendous importance that school, State, National, and independent organizations of corn clubs and associations of corn breeders and corn growers have centered their interests in this direction and have become active in a way that is certain to lead to success. Such clubs and associations are especially fitted for this most important work. By bringing together yearly the experiences of many members, and continuing their records indefinitely, corn growers may each year profit by all past experiences and results.

[1] This syllabus has been prepared by direct cooperation between the Office of Corn Investigations, of the Bureau of Plant Industry, as regards subject matter, and J. M. Stedman, Farmers' Institute Specialist, of the States Relations Service, as regards pedagogical form. It is designed to aid farmers' institute and other extension lecturers in presenting this subject before popular audiences. The syllabus is illustrated with 52 lantern slides, as listed in the Appendix. The numbers in the margins of the pages refer to the lantern slides as listed in the Appendix.

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View. Poor corn crops are usually attributed to unfavorable weather conditions, and frequently this is the true cause, for there are but few summers during which this crop does not suffer more or less at some stage in its growth. The most that can be done regarding the weather is to take the best possible advantage of the conditions as they exist. But there are other conditions that are responsible for low production—conditions that are directly under the control of the farmer—and it is these that make possible the doubling of the average yield per acre within a few years.

SOIL REQUIREMENTS.

The soil should be fertile, well drained, and loose to a considerable depth. A good corn crop can not be produced on hard, depleted soil. Some growers from force of habit, perhaps, every spring plant corn on land which they know is too poor to produce a profitable crop. While this practice con-
2 tinues the soil as well as the farmer will remain poor. The plowing and cultivating of poor soil is as expensive as the plowing and cultivating of fertile soil. The man who cultivates poor soil and harvests poor crops can not profitably compete with his neighbor who grows good crops with but little, if any, greater expenditure of labor or capital. Corn growing should not be attempted on poor land. Such land should first be brought into a fertile condition by the growing and plowing under of leguminous crops, the application of
3 manures, etc. In the meantime some crops that require less fertility than corn may be grown. It should be remembered that the nature of the corn plant is such that it will not produce grain unless the soil is rich enough to afford a con-
4 siderable growth of stalk, and that, in general, the richer the soil the heavier will be the yield of grain. Other plants will often produce fair crops on soil too poor to produce corn.

Since the nature of the season can not be foretold it is impossible to predict whether high land or low land will produce better, but as corn makes a tall, vigorous growth, requiring much moisture, low land, usually being better supplied with both moisture and fertility, is likely, if well drained, to produce better than high land. In many cornfields throughout the country may be seen portions or spots on which it is impos-
5 sible for corn to thrive. These may be clayey spots or swampy or undrained areas, or ground adjacent to timber. It is too great a waste of labor to plow, harrow, and cultivate such unproductive spots. They should be improved so that they will yield a profit, or they should not be planted at all. The

poor clay spots should be enriched, the swampy places drained or filled, and the corn should be planted farther from the timber, with a strip of timber grass next to the trees. View. 6

Alfalfa, clover, and similar plants send their roots to great depths and are the best crops to turn under for the purpose of growing a very large corn crop. Their culture is the best and most economical way of subsoiling as well as enriching land. The deep-growing roots loosen the subsoil and keep it porous long after the crop is turned under, and the nitrogen fixed in the soil by the growth of the plants greatly enriches the soil. Without sufficient rainfall, however, poor corn crops are sometimes obtained on alfalfa sod, the soil moisture having been exhausted to a great depth by the roots of the alfalfa. 7

Under no circumstances should corn be grown continuously on the same soil. Some very rich alluvial soils have produced very good crops for many years in succession, but better crops would have resulted if a rotation of crops had been practiced. On fertile farms where it is necessary to make corn the principal crop it might be considered good farm practice to plant corn two years in succession on the same field, but not longer. When corn is grown continuously on a field for several years the vegetable matter of the soil becomes depleted and the soil becomes compact, difficult to work, and a poor home for corn plants. 8 9 10

When legume crops like alfalfa are grown between the crops of corn the soil continues to remain loose and friable and well supplied with vegetable decay and nitrogen. 11

PREPARATION OF THE SEED BED.

Land is plowed in order to loosen it so that water may enter in greater quantity, be absorbed to a greater depth, and remain longer in the soil. A deep seed bed well supplied with soil moisture and well drained makes a big corn yield *possible* whether the summer proves too dry or too wet. If not well plowed, some lands are so impervious that during several weeks of rainy weather they remain dry below a depth of 5 or 10 inches.

In many localities it is best to plow in the fall or several months before planting, in order to enable the soil to store a sufficient quantity of water to produce a corn crop. Fall plowing can not be recommended for all soils and localities, but it should be more generally practiced than at present. If a cover crop or sod is turned under in the autumn, decomposition will increase the amount of plant food available for the crop the next summer. This is true to some extent, even though the sod is not turned under, inasmuch as the simple 12

View. loosening of the soil admits atmospheric oxygen and increases chemical action on vegetable and mineral matter. Besides, fall and winter plowing is one of the best methods of combating grubworms, cutworms, and corn root-worms, which are often destructive to corn.

Because the surface of soil plowed in the fall is drier at planting time in the spring than that of ground not so treated it does not necessarily follow that there is less moisture in fall-plowed ground. The fall plowing has enabled the rainfall better to penetrate the subsoil, thus relieving the surface of its excess of moisture. In the spring fall-plowed fields usually contain much more moisture, but at the same time have a drier surface than fields which remain unplowed until spring. In sections where there is much rain during the winter, it is better not to harrow the fall-plowed land in the autumn. This is especially true of fine clay soils that run together and pack readily. In comparative tests of fall and spring plowing, preceding a dry summer, the fall-plowed fields have generally yielded better. The same is true of subsoiling. Deep spring plowing and spring subsoiling are likely to result in diminished crops, especially if done after the spring rains. The loosening of the soil to great depths at this time admits air and facilitates the loss of soil moisture; it also interrupts the capillarity, so that moisture is not as readily drawn from greater depths, and during a dry summer there is not enough available moisture to support a good crop.

In some localities it is necessary to grow rye or some other crop on fall-plowed land to prevent erosion. Heavy cover crops moreover should be turned under in the winter or very early spring in order to give time for decay before the corn is planted on the land.

If plowing is done in the spring shortly before planting
13 time, it is necessary that the soil be in proper condition to pulverize readily. Disking land in the spring before plowing is a great advantage. It makes the soil retain moisture and keeps the land longer in a good plowing condition. It also pulverizes the surface portion of the furrow slice before it is turned under out of reach of the harrow. Land should never be plowed when too wet to pulverize finely. However, plowing may be sometimes done in the fall when the ground is too dry, as winter rains and freezing will pulverize the clods.

Spring-plowed land should be harrowed the same day it is plowed. If very dry, harrow both at noon and night. The moisture saved by harrowing before the ground has had time to dry out is surprisingly great and, besides saving moisture, it

will often put the soil in better tilth than two harrowings after the clods have dried. The change also makes the work less tiring to the team, which alone offsets the trouble caused by changing tools. View.

When the soil is loose to a sufficient depth, corn roots penetrate in abundance to a depth of 3 or 4 feet. The growing of clover and deep-rooted plants preceding corn loosens the soil for the corn, and subsoiling is profitably practiced with some soils to enable the corn roots to use the soil to greater depths and to increase the water-absorbing capacity of the soil as well. As the crop on an acre is limited to 43,560 square feet of surface, it should be enabled to use the acre to a great depth. In compact soils plowed but 6 inches deep and cultivated 3 inches deep there remain but 3 inches of loose, plowed soil in which the corn roots can feed undisturbed by summer cultivation, but if plowed 10 inches deep and similarly cultivated there remains more than twice as much loose, undisturbed soil for the corn roots. 14

For a deep, rich soil deep plowing is therefore best, providing it is done in the fall or does not render the soil too loose and dry. For thin clay soils subsoiling is better than very deep plowing, because it does not turn the compact clay to the surface, yet at the same time it loosens the soil to a good depth. The plowing should not be at the same depth from year to year, as by such a practice the soil is not mixed well, and a hardpan may be formed at the bottom of the furrows where the horses walk and the plows drag. A thin layer of subsoil turned to the surface occasionally so that it is exposed to weathering, gradually mingles with surface soil and vegetable growth, and the soil depth thus becomes increased. It is well, therefore, to plow a little deeper each year for several successive seasons, and then for one season to plow at about half the depth of the deepest plowing. The plow should be so adjusted that it will turn all the soil and leave the surface smooth. In every instance, spring-plowed land should be pulverized *the same day* it is plowed.

Where a heavy growth of clover or weeds or a heavy application of manure has been plowed under in the fall, the land should be given, just previous to planting, a cultivation as deep as it was plowed. This deep cultivation mixes the humus throughout the soil and is of more value than any cultivation the corn crop can be given. It is economical, because wider cultivators and more horses can be employed per man than is possible after the corn is planted.

View.
15 As a general rule, corn should never be planted before the seed bed is thoroughly prepared. Planting in a poorly prepared seed bed for the single purpose of getting the seed in the ground early rarely pays. With a well-prepared seed bed the cultivation of the corn is, in a sense, half done.

SEED.

There is each spring a scarcity of good seed corn. This condition is all the more regrettable, because it need not exist; and it is much more serious than commonly supposed, because many do not fully realize the tremendous loss to themselves and the country due to planting inferior seed. A full stand of plants may be obtained from inferior seed, but the yield will not be the best possible. The loss is due to delay or negligence. It can be prevented by the selection of seed corn in the autumn.

Seed corn that comes up but produces an unprofitable crop is worth less than seed that will not grow at all, because a greater amount of labor and the use of the land are lost. The seed corn that produces the best crop is the cheapest. A bushel of seed corn will plant 6 acres. Seed that gives an 18-bushel increase per acre is worth $20 to $40 more per bushel. Careful breeders of productive strains of corn are needed in every community, and growers who do not care to grow a special seed patch and select their seed with care should buy the best seed obtainable. Begrudge not your neighbor $3 a bushel for properly selected and dried seed of a variety which has made good in the neighborhood, but refrain from paying a stranger $5 an ear for seed said to produce 400 bushels to the acre.

To be first class, seed must be:

(1) Well adapted to the seasonal and soil conditions where it is to be planted.

(2) Grown on productive plants of a productive variety.

(3) Well matured, and preserved from ripening time till planting time in a manner that will retain its full vigor.

The importance of the three requirements just enumerated has been demonstrated experimentally. The results given briefly, as enumerated, are as follows:

16 (1) For a series of five years, 12 varieties were tested in 10 northern States, equivalent lots of seed being used in each State. Varieties that produced most in some States were among the poorest in others.

(2) Seed ears taken from the highest yielding rows of ear-to-row breeding plats have repeatedly produced better than seed ears taken from poorer yielding rows. Seed ears from the best producing stalks found in a general field produced more than seed ears taken without considering the productiveness of the parent stalks. View. 17

(3) Four bushels of ears were divided into two equal parts, one part being well taken care of and the other placed in a barn as corn is ordinarily cribbed. The well-preserved seed gave a yield on poor soil 12 per cent higher than the poorly preserved and 27 per cent higher on fertile soil, notwithstanding the fact that both lots of seed germinated equally well.

Seed corn that matures normally and has been properly preserved will grow satisfactorily. It is very poor management to neglect proper preservation and to spend time in the spring separating by germination tests those ears that have been badly damaged from those that have been slightly damaged. Prevention is better than cure, and in this case a cure is impossible. Ears slightly damaged by poor preservation may germinate well, but will produce less than if they had received better care.

Make some rag-doll testers and test 100 ears separately. Be sure that each kernel tested is perfect in appearance and was not injured at the tip when removed from the ear. If 36 per cent or more kernels from any ear fail to grow or make a weak growth, it will be advisable to test every ear in the entire supply of seed corn. If the 100 ears tested contain no poor ones, further testing of the supply is unnecessary. 18

Shelled corn is difficult to grade satisfactorily. The grading can be done better before the ears are shelled. If the seed ears vary greatly as to size of kernel they should be separated into two or three grades according to size of kernel. These grades should be shelled separately, tested in the corn planter, and numbered to correspond with the number on the planter plates that are found to drop them most uniformly. These arrangements can be completed before the rush of spring work begins.

The first operation in properly shelling seed corn is the removal of the small kernels from the tips of the ears and the round thick kernels from the butts. The former are less productive than the other kernels of the ear. The round butt kernels are as productive as the other kernels of the ear, but do not plant uniformly in a planter.

View. Shelling seed corn carefully by hand is profitable. The
19 greater the acreage planted the greater the profit. Each ear should be shelled separately into a sieve, rejecting any worm-eaten or blemished kernels. If the grain from one ear appears good and contains no poor kernels, it is poured into the general supply and another ear shelled in the same way.

PLANTING.

A successful planting, a satisfactory stand of plants, and a profitable yield are largely assured by getting the seed bed in perfect condition for very early planting and then waiting to plant until the soil is warm and moist.

There are many questions concerning implements, methods, distance between rows, thickness of planting, etc., that should be definitely settled before planting time. These questions are governed to a large degree by local conditions.

A distance of 3.3 feet between corn rows is suggested for the majority of cases. Some 2-row planters are more easily adjusted to 3 feet 4 inches, which is equally satisfactory. More space is required for tall-growing than for smaller varieties. It is well to drop somewhat more kernels than the number of stalks desired. On good soil this familiar saying may be profitably followed: "One for the blackbird, one for the crow, one for the cutworm, and three for to grow." One secret of a good corn crop consists in having the proper stand of stalks, each one of which yields well. On poor land and also in very dry sections larger grain yields can be secured with a thin stand of stalks. Under such conditions, however, some other crop can usually be grown more profitably than corn, for corn requires much moisture and fertility. Where the annual rainfall is less than 25 inches a thin stand of stalks is preferable unless moisture is supplied from some other source than rain. Where soil moisture is likely to be deficient during the silking period a stalk for each 20 inches of row (the rows being 3.3 feet apart) is sufficient and will make possible a yield of 113 bushels per acre if the stalks average a pound of grain each.

With an abundance of fertility and soil moisture throughout the silking period a stalk for each 12 inches of row will make possible a yield of 188 bushels per acre, the stalks averaging 1 pound of grain each. With rich soil and ample rainfall 12,000 or more stalks to the acre are necessary for obtaining record yields.

In planting corn in hills practically all corn planters drop all the kernels of the hill in a bunch. Bunch planting results
20 in unnecessary crowding both above and below ground, weak-

ening the stalks and reducing the yield. Kernel-spaced checking combines the advantages and overcomes the disadvantages of drilling and checking, and there is need for an implement that will combine the advantages of kernel spacing and hill checking. View. 21

Planting by hand has some advantages, but the labor saved by the use of planters is so great that for profitable corn growing their use is indispensable. Moreover, if the seed is in proper condition any good planter can be made to cover corn as satisfactorily as it can be done with a hoe; and if seed ears having kernels of uniform size be selected and the small and misshapen kernels at the extremities of the ears be rejected, good modern corn-planting machines can be made to drop with sufficient accuracy for practical purposes. However, the yield depends to such an extent upon the proper number of stalks and their even distribution that too much stress can hardly be placed upon the necessity for selecting seed ears having kernels of uniform size and plates for the planter that will drop the right number at the required distance. Every spring the planter should be thoroughly tested and adjusted until it will drop accurately the seed to be used. The kernels of different kinds of corn vary so much in size and shape that it is necessary to adjust the planter to each kind of corn to be planted. These are some of the many essentials that can be attended to before the rush of planting time arrives.

Perhaps more corn is now planted by means of a checkrower than by any other device. This implement is adjustable, so that the spacing of the rows and the distance between the plants or hills in the row can be regulated to suit the requirements of the soil. By means of a wire chain stretched across a field one man and team can plant in straight rows in both directions across the field 12 or 15 acres per day, thus admitting of cross cultivation. Corn planted in this way can be kept free from weeds and well cultivated without costly hoeing or cutting of weeds. A summary of numerous tests made by various State experiment stations shows that there is practically no difference in yield of corn planted in hills of several stalks each or drilled so that the stalks stand separately in the rows, provided there is the same number of stalks per acre in each case. The former system facilitates cultivation, and the latter provides for a more equal distribution of roots throughout the soil. Checkrowers are best adapted to large and comparatively level fields free from trees or stumps. Hillsides and sloping ground can not be planted in checks without increasing the liability to soil washing. 22

View. The proper depth to plant must be governed by the quality and moisture of the soil. If the soil is a stiff, heavy clay containing plenty of moisture at planting time, 1 inch is sufficiently deep; but if it is a light, open, dry soil, 3 or 4 inches is a satisfactory depth. If the corn is planted deeper than 4 inches much of the food supply stored in the seed will be consumed before the young plant can reach the surface and expand its leaves. Plants can not be made to send their roots deeply into the soil by planting the seed deeply. They can be better fortified
23 against dry weather by planting the seed in a furrow, covering it slightly, and then gradually cultivating the furrow full of soil as the plants grow. This requires some care, however, as the furrows should not be filled to any great depth until the plants have attained a height of 2 feet or more and have established their root system at the desired depth. This method of planting is especially well adapted to deep soils where dry weather is likely to prevail during the middle or latter part of the growing season. The lister, the implement with which a large part of the corn is planted in the prairie States, fulfils the requirements of this method of planting.

Some successful growers of corn have found it profitable to use a two-row marker set the same width as their checkrower. The checkrower follows in the deep furrows, thus securing all the advantages of both listing and checking.

Replanting seldom increases the grain yield. Cultivating up the first planting and planting the entire field the second time is better than replanting a poor stand.

THINNING.

For highly profitable crops heavy planting and thinning are advisable, though not always practicable in extensive planting. Thinning should be performed as soon as the stalks are
24 too hard for cutworms to cut off and before they are a foot tall. A flattened broomstick or a similar stick to which is fastened a flattened piece of iron, like a 2-inch chisel, is of great assistance in thinning, as it is necessary to remove the stalks below the surface of the ground in order to prevent further growth. Slightly more stalks than a perfect stand should be retained, so that injured, diseased, or feeble stalks can be removed later without reducing the stand below that required for the best grain yield. Such stalks should be considered as weeds and removed as soon as their inferiority is evident.

CULTIVATION.

The most successful corn growers realize the importance of thorough early cultivation, thus preventing any check in the growth of the plants because of weeds or crusted soil. The farmer should see that, from the time of germination to the maturing of the corn the plants are not subjected to any preventable unfavorable conditions, but are given an opportunity to make a steady, vigorous growth. If their development is checked from any cause they will never fully recover, no matter how favorable the later treatment. As a consequence of heavy rainfall the stalks may increase rapidly in height, and at the same time, for lack of cultivation or of soil fertility, or for some other reason, they may be slender or of poor color. Thrifty corn plants are thick, strong, and of dark-green color. View.

Horse weeders and harrows should be used when needed to break a surface crust, check insect depredations, or kill young weeds that start before the corn is up or large enough to be worked with other implements. During the first cultivation, or while the plants are very small, narrow shovels that throw the soil but very little should be used, and fenders are usually found desirable to prevent the covering of the plants. 25 26

Many comparative tests of deep and shallow cultivation have been made, and on the whole the results are in favor of shallow cultivation. There are but few occasions when deep cultivation is preferable. If excessive rains have packed the soil and kept it water soaked, deep cultivation will help to dry and aerate the soil. Breaking the roots of the plants must be avoided so far as possible. If roots are broken, the plants will rapidly produce other roots, but it will be at the expense of the vitality and food supply. After the plants have reached a height of 2 or 3 feet, the soil, even in the middle of the rows, should not be cultivated deeper than 4 inches, and usually a shallower cultivation will prove better. For retaining soil moisture a loose soil mulch 2 or 3 inches in thickness should be maintained. 27

The best answer to the question of how frequently corn should be cultivated is that it should be cultivated often enough to keep down weeds and to maintain constantly a loose soil mulch until the corn has attained its growth. To this end a greater number of cultivations will be necessary when rains at intervals of about a week cause the surface soil to run together and crust. This crust must be broken and the soil mulch restored, or evaporation will soon rob the soil of its moisture. It is a mistake to think that the longer the drought the more

View. frequent should be the cultivations. After a fine mulch of about 3 inches in depth has been produced its frequent stirring is not necessary, except in so far as it is required to keep weeds from starting. The essential object of cultivation is to restore the soil mulch as soon after a rain as the condition of the ground will permit. If this time is allowed to pass and the ground becomes hard and baked, the crop will suffer greatly, for
28 the cultivation of hard, dry ground breaks it up into clods, causing more injury than if such cultivation had not been given at all. All observant farmers have seen crops injured in this manner. Many crops are cut short by stopping the cultivation, because the corn is too tall for the use of a double cultivator without breaking down the stalks. If the condition of the soil demands it, shallow cultivation should continue, even
29 though the corn is tasseling. A small implement with several narrow blades and a short singletree may often be used for maintaining a soil mulch after the corn is too tall for the use of
30 double cultivators. Some forms of the one-horse cultivator are especially adapted to cutting off weeds. Blocks nailed on the handles of the implement will protect the hands from the corn blades.

It is sometimes profitable to remove weeds even by the costly process of hand hoeing and at as late a date as the silking time of the corn.

With a good riding or walking double cultivator one man can cultivate as many acres as two men with a one-horse cultivator, and with the most improved types he can accomplish the work more easily and fully as well. Because of this saving of labor, double cultivators should be used wherever practicable. Two-row cultivators equipped with four gangs of shovels and drawn by three horses are meeting with favor in the central
31 prairie States. As one of these completes the cultivation of two rows of corn each time it crosses the field, one man can cultivate 15 acres per day. In many sections it is often difficult to obtain laborers when they are needed and, as with these two-row cultivators one man can cultivate as many acres as two men with double cultivators, their use is likely to increase, especially in comparatively level sections free from stumps and rocks where corn is planted by means of two-row planters. Some forms of these two-row cultivators are mounted on two wheels, like two-horse double cultivators, while others made for plowing listed corn are carried on runners or low, broad wheels designed so as to follow the rows made by the lister. Three-row cultivators of this type are used to some extent on

large fields free from obstructions. Very stumpy land or tall corn may necessitate the use of one-horse cultivators. View.

The kind of shovels with which it is best to equip either single or double cultivators must be determined by the character of the soil, size of the corn, and the size and nature of growth of the weeds to be destroyed. Without exception, any form of shovel found to do good work on a one-horse cultivator can be attached to a double or two-row cultivator. In some cases the surface cultivator does better work than the disk cultivator which may leave narrow strips of solid soil that are 32
not covered with fine, loose soil. All forms of shovels should be so adjusted that the loosened soil will make a fine and even covering for the harder soil beneath. Shovels sometimes 33
may be modified at the farm blacksmith shop for special use on river-bottom land, where bindweed, man-of-the-earth, and other vines and weeds are hard to control. Sharp horizontal blades at the bottom of shovels strike the weeds squarely, so that there is little chance for them to escape by slipping by either side, as is so common with ordinary shovels.

SELECTION AND CARE OF SEED CORN.

Autumn is the time to prepare for a profitable corn crop the following season. At corn-ripening time drop all other business and select an abundance of seed corn. The process is too important to be conducted incidentally while husking. When selecting seed corn give the process your entire attention. Get the very best that is to be had and preserve it well, and your increased yields will return you more profit than any other work you can do on your farm.

In 13 years' investigations conducted upon Scioto River bottom soil near Piketon, Ohio, with Woodburn White Dent, U. S. Selection 77, the yield was raised from an average of 63 bushels of dry shelled corn from 1901 to 1907 to an average of 75 bushels from 1907 to 1913. The principal influence producing this increase in yield was the selection and the care of seed corn.

The only proper way to select seed corn is from the stalks standing where they grew, as soon as ripe and before the first hard freeze. As soon as the crop ripens, go through the field with seed-picking bags, and husk the ears from the stalks that 34
have produced the most corn without having any special advantages such as space, moisture, or fertility. Avoid the large ears on stalks standing singly with an unusual amount of space around them. Preference should be given the plants 35
that have produced most heavily in competition with a full

View. stand of less productive plants. In all localities the inherent
36 tendency of the plant to produce heavily of sound, dry, shelled corn is of most importance. Late-maturing plants with ears which are heavy because of an excessive amount of sap should be ignored. Sappiness greatly increases the weight
37 and is likely to destroy the quality. In the Central and Southern States, all other things being equal, short, thick stalks are preferable. Short stalks are not so easily blown down and permit thicker planting. Thick stalks are not so easily broken down and in general are more productive than slender
38 ones. The tendency for corn to produce suckers is hereditary. Other things being equal, seed should be taken from stalks that have no suckers.

The same day seed corn is gathered the husked ears should be put in a dry place where there is free circulation of air and placed in such a manner that the ears do not touch each other. This is the only safe procedure. Good seed is repeatedly ruined because it is thought to be already dry enough when gathered and that the precaution mentioned above is unnecessary. Many farmers believe that their autumns are so dry that such care is superfluous. Seed corn in every locality gathered at ripening time will be benefited by drying as suggested. If left in the husk long after ripening it may sprout or mildew during warm, wet weather or become infested with weevils. The vitality of seed is often reduced by leaving it in a sack or in a pile for even a day after gathering. During warm weather, with some moisture in the cobs and kernels, the ears heat or mildew in a remarkably short time. The best possible treatment immediately after gathering is to string the ears.
39 Ordinarily the best place to hang strings of ears is in an open
40 shed or loft. Wire racks are more convenient, and in the end cheaper, than binder twine. Such racks may be made from electrically welded lawn fencing. The cutting of the fencing
41 into seed-corn racks is done without any waste.

Only during unusually damp weather at seed-gathering time will fire be necessary. If heat is employed in a poorly ventilated room it will do the seed ears more injury than good. If used, the fire should be slow, long continued, and situated below the seed ears, with good ventilation above them.

After hanging in the shed or lying on the racks for two months, the seed ears should be as dry as a bone and contain less than 10 per cent of moisture. They can remain where they dried or be stored in mouse-proof barrels, boxes, or crates during the winter, but in either case they must not be exposed to a damp atmosphere, or they will absorb moisture and be in-

jured. Some farmers place the thoroughly dried seed ears in the center of a wheat bin and fill the bin with loose, dry wheat.

In localities where weevils and grain moths injure stored grain, the thoroughly dry seed ears should be stored in very tight mouse-proof receptacles with 1 pound of moth balls or naphthalene inclosed for each bushel of corn. This quantity tightly inclosed with the corn will prevent damage from these insects and will not injure the seed. If at any time signs of weevils or grain moths show on the corn, it should be inclosed with carbon bisulphid in practically air-tight rooms, bins, boxes, or barrels for 48 hours. The bisulphid should be placed in shallow dishes or pans on top of the seed. One-half pint is sufficient for a box or barrel holding 10 bushels or less. One pound is sufficient for a room or bin 10 feet each way. After fumigation the ears must be thoroughly aired, taking care that no fire is present when the fumigating box is opened.

HARVESTING AND STORING THE CROP.

THE SILO.

On many well-managed farms the work of harvesting and storing the corn crop begins with the filling of the silo. Corn is one of the best crops for this purpose, if not the very best. Sorghum stands dry weather much better than corn and for dry regions is a surer crop, but it is more inclined to fall down and become tangled than corn, thus making it somewhat more difficult to place in the silo. This difficulty is overcome to a large extent by growing the two crops together, and the silage made from these two crops grown together is usually superior to that from either crop grown separately.

When the silo first came into use it was thought necessary to fill it with very green succulent growth. This is now known to be an erroneous idea, and the silo is regarded much as a storeroom or food preserver, the value of the silage depending to a very great extent on the nutritive value of the crop with which the silo is filled. To this end it is advisable that the corn shall have reached a degree of ripeness indicated by rather hard, well dented or glazed kernels and partially dried husks before it is placed in the silo. There is a week or 10 days when the ears are in this condition and the stalks still contain sufficient sap to cause the silage to pack well in the silo. It is even better to add a little water to accomplish the latter purpose than to cut the crop before it has attained its full feeding value.

STRIPPING.

View. In some sections the practice of stripping the blades by hand from the standing stalks was for years one of the established operations in connection with harvesting the corn crop. The blades when thus gathered and well stored furnish an excellent forage, but there are now cheaper methods of harvesting without any loss in quality.

TOPPING.

43 It is still quite a common practice in some localities to top the stalks by cutting them just above the ear. By this method the portion of the stalk which is eaten by stock most readily and with least waste is obtained. When the grain crop is late in maturing, or wet fall weather prevents the proper drying of the ripening ears, the topping of the corn may be found advisable. If the ears have become hard, the kernels dented, and the husks partly dry before the topping is performed, no reduction in yield will result. A heavy growth of cowpeas may make the cutting of the entire plant impracticable and warrant the topping of the crop. If the corn is desired for seed, topping will facilitate the drying of the ears and thus make it possible to select the seed before it is injured by freezing. Ordinarily, however, it is found more expensive to top a corn crop than to cut and shock the entire plant.

CUTTING, SHOCKING, AND HUSKING.

Over large areas in the principal corn-growing States corn is grown primarily for the grain, and each farmer decides for himself how much of the crop will be cut. This is usually determined by cutting just enough to feed the animals maintained on the farm. The chief objection to this method is that many farmers do not maintain enough animals to consume all of the corn stover produced. If the ears are gathered from the standing stalks and no use is made of the stover,
44 fully one-third of the crop is wasted. The term "fodder" is applied to the entire plant as ordinarily cut and shocked, while the term "stover" is applied to the portion remaining after the ears have been pulled or husked.

Generally speaking, there is little difference in cost between husking and cribbing corn from the shock and husking and cribbing it from the standing stalk. In some sections men will husk from standing stalks at a lower price than from shocks, but the cost of teams, although they are not usually very busy with other work during corn-husking season, must be taken

into consideration. Considering the expense of husking from the standing stalk and from the shock as equal, it is evident that the stover has been obtained for the money paid for having the corn cut and shocked. This cost of cutting and shocking is very much less than the value of the stover, if it be properly stored and fed. If left in the field until February or March exposed to the winds and rains of winter, it is questionable whether its feeding value is equal to the cost of cutting and shocking. View. 45

There are sections in the Central and Southern States where the soil is rich and the growing season long, causing the corn to make a large, tall growth of stalk which does not furnish a good quality of stover. In such sections it may be better to obtain the necessary quantity of forage by cutting several hay crops each year than by saving the corn stover. This is especially true in localities where warm, damp weather causes the corn stover to lose its feeding value rapidly.

Jerking the ears and storing them unhusked is a method of harvesting employed in some sections, especially in the South, where the argument usually given in its favor is that if the husks are on the ears they are more protected from the grain weevil. The destruction of corn by this insect is one of the drawbacks to more extensive corn culture in the South. As soon as the corn becomes dry enough to crib, weevils are frequently found working under the husks on the kernels of the ears, sometimes to the number of 20 or more to the ear. It is a question whether the corn is more seriously injured by transferring the weevil with the unhusked ears to the crib than would result were the corn husked in the field, causing the weevils to drop to the ground and thereby leaving most of them in the field.

The total amount of work required to jerk the corn and afterwards husk it is considerably greater than that required to husk it directly from the standing stalk, and the quantity of forage obtained by gathering the husks is not sufficient to pay for the extra work. Much better forage could be obtained more cheaply by other methods. If the husks are sold advantageously for mattress making it is well to perform the two operations of jerking the ears and afterwards husking them in a manner that will furnish husks of good quality. The proportion of husk varies greatly among the different kinds of corn, but it is sufficient to say that it requires fully one-half more room to store the ears unhusked than husked.

View.

In sections where the farms range in area from 80 to 160 acres, and diversified farming is followed so that all of the stover is fed, husking from the shock is a common method of
46 harvesting the ears. For keeping the ears clean and to facilitate loading the piles of corn into the wagon, sheets of ducking 6 or 7 feet square are of very great assistance and should be universally used rather than to throw the ears upon the ground, where they may become damp or even muddy and from whence it is necessary to pick them by hand. As the corn should be hauled and stored soon after it is husked, a great supply of these sheets is not necessary, for as soon as the pile of corn from one shock is loaded the sheets are ready for use at other shocks. Where the shocks yield 4 or 5 bushels of corn it will be necessary to throw some of the ears into the wagon by means of a basket; the remaining ears can then be thrown into the wagon quickly by two men, each taking hold of two corners of the canvas and transferring the corn on the sheet directly into the wagon. Boxes or troughs in some sections are employed in place of sheets, but the sheets are lighter and in every way more satisfactory. During very dry and windy weather corn should not be husked from the shock, as the loss of stover is too great. Calm days when the fodder is slightly damp are ideal for husking shocked corn.

BINDERS.

The corn binder with bundle carrier is satisfactorily used in cutting corn of average or small size on land that is not
47 very steep or stumpy. On the comparatively level prairie land of the North Central States the corn binder is very generally used in cutting and shocking corn. In light corn or on level land two horses will suffice, but for faster work or heavy corn the use of three or four horses is much more satisfactory. Three men, one to run the binder and two to shock, and two teams can cut and shock about 7 acres of corn a day. However, conditions vary to such an extent regarding the weight of the corn crop, the lay of the land, etc., that it is impossible to give figures that will apply to all cases. In sections where the corn binder is successfully used the principal objections to its use are the cost of twine which remains upon the fodder but a short time, and the knocking off of ears in the process of binding. In almost all cases the quantity of corn knocked off by the binder is great enough to warrant driving a wagon over the field and gathering the ears from the ground after the corn is cut and shocked. This is necessary, because the presence of the shocks in the field prevents the turning in

of hogs or cattle to gather up the ears knocked off by the binder. View.

The use of a binder with a bundle carrier saves very much of the hard labor of cutting and shocking, and the greater ease of handling the fodder when bound into bundles of convenient size saves labor enough to compensate for the twine used.

The stubble cutter should be attached to the corn binder whenever possible, as the early cutting of the stubs hastens their decay and puts the ground in a better condition for the following crop.

HUSKERS AND SHREDDERS.

The use of shredding machines is quite general in many corn-growing sections. Sometimes the machines are used for shredding the stover after the ears have been husked from the shocks by hand, and in other cases both the husking and shredding are done by the machine. The shredding of the stover puts it in a more compact form for storing and a more convenient form for feeding and avoids the troublesome work of handling manure in which there are long coarse cornstalks. Shredded stover is fed with much less waste than stover in any other condition. It has been estimated that shredded stover will go 40 per cent further in feeding cattle than the whole stalks and considerably further than when the stalks are put through a feed cutter. As there are shredders of varying capacities, a farmer may purchase a machine suited to the quantity of work to be performed, or a number of farmers in a community may own a machine jointly. Shredding fodder by the acre and shredding and husking by the bushel are common in many sections where crews operate huskers and shredders and travel from farm to farm. The blowing of the shredded material from the shredder and husker to the center of a feed shed, so that it can be fed in racks around the general supply, is a very economical way of using corn stover. 48

STORING THE STOVER.

Whether the stover is shredded or not, it is of great importance that it be well stored and not left long exposed to the weather. The mistake is sometimes made of placing the hay crop in sheds and barns and leaving the corn stover in shocks in the field. The reverse is better, inasmuch as most kinds of hay will not depreciate so rapidly in feeding value and will keep better in stacks and ricks than corn stover. Unless placed under cover corn stover should be fed in the fall and early winter. If left exposed until February or March it has little feeding value.

View. In the principal corn-producing States the autumns are usually dry, and corn fodder dries thoroughly in the shocks and is shredded and stored in barns or feed sheds with little danger of heating or molding. The fodder should not be wet when shredded and stored, but damp days are preferable for doing the hauling and shredding because the blades are more pliable and the fodder is therefore handled with less waste. But in some sections, especially in northern States, where the corn is full of sap when cut, and where damp fall weather prevails, much care is necessary in storing corn fodder or stover to prevent heating and molding. In such localities it should be placed under cover in ricks not more than 6 or 8 feet in thickness, or, if shredded, layers of dry straw several inches deep should alternate with layers of the shredded stover. The depth of the layers of stover can vary from several inches to a foot or more, according to its dryness when stored. The dry straw will take up some of the moisture from the stover and prevent heating.

STORING THE GRAIN.

There was a time in the history of the corn-producing belt when rail pens were about the only available means of storing the corn crop. Much to the discredit of some corn growers this method of storing is still in vogue, even in sections where good means of storage could be afforded at little expense. It is no uncommon sight to see rail pen after rail pen filled with ears of
49 corn and without any cover, exposed to all the rains and snows of winter, and these in sections of the country that produce the most corn and are consequently most interested in higher priced corn. This corn remains in apparently good condition during the cold weather and is usually placed upon the market in early spring. Filled with water, it is not long after it is loaded into box cars or vessels until it heats and spoils. The installation of elevators where such corn can be kiln dried has been brought about by this poor manner of storing the corn crop. There is a general prejudice against kiln-dried corn, resulting from the fact that kiln drying was first employed and is at present employed to a very large extent to prevent further heating and fermentation of corn that was not allowed to dry properly or was poorly stored before being placed upon the market. This state of affairs, which results from allowing the corn to remain wet during winter and necessitates the the removal of the water by expensive means, keeps the price of corn lower than it would be if the corn were allowed to dry in the fields and were kept dry until placed upon the market.

Grain buyers would pay a better price if the general supply of corn reached them in a condition that would insure its preservation without drying and the resulting shrinkage. View.

In addition to affording thorough ventilation to the stored grain and protection from driving rains, cribs should be constructed in such a manner that they can be filled and emptied with the least possible labor. For level ground double cribs 50
with an elevated driveway and approaches that will enable the loads to be driven through the cribs and dumped or scooped out of the wagons without any high pitching are very satisfactory.

PROTECTION FROM INSECTS, MICE, AND RATS.

In sections where insects are destructive to stored grain, cleanliness is of value in preventing injury from this source. Small quantities of grain should not be left in the cribs during the summer, as they tend to harbor these pests. Where insects are destructive to the stored grain, it is a good practice to dispose of the entire crop as early as possible and clean the cribs thoroughly, so that there are left few hiding places and no food to carry the insects through the summer. In southern localities, where the weather is warm enough to permit these pests to work throughout the entire year, it is best to construct the cribs so that they can be made practically air-tight and then to treat the crop with some insecticide such as carbon bisulphid. If this plan were thoroughly carried out the corn weevil could be practically exterminated.

As a protection against rats, mice, and sparrows, galvanized wire cribs are coming into use. Wire netting of about 51
one-fourth inch mesh can also be successfully used in the construction of frame corncribs. This wire netting can be tacked to the inside of the uprights of the crib, and the strips which constitute the sides of the crib can also be nailed on the inside of the uprights, thus holding the wire netting in place. As a floor, which should be 18 inches or more from the ground, so as not to afford a hiding place for rats, the wire netting can be tacked to the sleepers and the flooring nailed over to hold the wire in place. For overhead protection the wire netting is simply tacked to the joists.

If cribs are built upon solid concrete foundations through which rats can not burrow no netting will be needed, for the floor and the structure can be kept near the ground. With ample roof projection and upper ventilation no danger from dampness need be feared.

SHRINKAGE.

View. The shrinkage that will take place in a crib of corn from the time it is cribbed in the fall until it is sold varies so greatly in accordance with the amount of moisture the corn contains when placed in the crib, and also the ventilation of the crib, that it is impossible to state a percentage of shrinkage that will apply with certainty to any particular crib of stored corn. Various tests show that during the first year the shrinkage in cribbed corn approximates 15 per cent for the first year and 20 per cent for two years.

Corn that has been kept dry during the winter is usually disposed of in early spring, for the reason that it is likely to spoil upon the approach of warm weather.

WHAT CONSTITUTES A BUSHEL OF CORN.

52 The laws of the majority of States recognize 70 pounds of ears as a bushel of corn. Some few States specify that previous to January a bushel of ears shall weigh 72 pounds. Almost without exception the State laws specify that 56 pounds of shelled corn shall constitute a legal bushel. Unless the strain of corn has exceedingly large cobs and short kernels, the legal bushel of 70 pounds of ears will yield when shelled 56 pounds of grain, or the legal bushel of shelled corn. A struck bushel of kernels of different strains of corn will vary in weight from 50 to 64 pounds.

APPENDIX.

LANTERN SLIDES.

No. of view.

1. Boys' corn-club field school, Tyler, Tex.
2. Poor corn on land farmed by tenant system.
   Corn one year in three, with land resting two or more years. Virginia.
3. Plowing under red clover for corn.
4. Heavy corn, yielding about 75 bushels per acre.
   A profitable crop. Land is very rich, sandy loam.
5. A wasteful, unproductive spot in a cornfield.
6. The corn should be planted farther from the timber.
7. Corn following alfalfa—one year to alfalfa on the right, two years on the left. Crystal Falls, Mich.
8. Crop on field growing corn continuously.
9. Corn on a 5-year rotation field.
10. Vertical section of soil growing corn continuously.
11. Vertical section of a soil near corn plant growing on newly broken alfalfa sod.
12. It is well to fall plow sod land for corn.
13. Soil in good condition to pulverize readily.
14. Vertical section of soil showing root system of corn plant.
15. A well-prepared seed bed.
    The seed bed should be thoroughly prepared before planting.
16. Variation in adaptability of different varieties of corn. Ohio.
17. Variation in individual ears of the same variety. Ohio.
18. The rag-doll tester.
19. After nubbing and grading each ear should be shelled by hand.
20. Result of bunching kernels in a hill.
21. Hill of corn with kernels properly spaced.
22. Checkrower planter at work.
23. A two-row planter with disk attachments for furrow planting.
24. A field of corn that was thinned and spaced.
25. Weeder in young corn.
26. Narrow shovels and fenders for early cultivation.
27. Root distribution at silking time.
    The bottom of the board represents the soil surface.
28. Injurious results from cultivation after the ground had become too dry.
29. Implement for maintaining a soil mulch in tall corn.
30. A one-horse cultivator well adapted to the shallow cultivation of small corn.
31. Two-row cultivator for corn.
32. Double cultivator equipped for surface cultivation.
33. Homemade shovels adapted to surface cultivation of bottom lands.
34. Select seed corn under field conditions.
35. A good ear, but size and quality may be due partly to the advantageous position which the plant had.
36. Rows of corn from two ears of the same variety, one borne high and one low on parent stalks.

No. of view.

37. Undesirable ears.
38. Ears which possess excellent visible characters.
39. A handy way to string seed corn.
40. A supply of good seed corn.
41. Showing how to cut wire fencing into seed-corn racks.
42. An economical and profitable way of caring for the corn crop.
43. A way of harvesting corn in the South, but rather expensive.
44. A common method of caring for the corn crop, but wasteful of the stover.
45. The feeding value of the fodder has been much reduced.
46. Husking from the shock is a common method of harvesting the ears.
47. A corn harvester at work.
48. A corn shredder with blower in operation.
49. Storing in rail pens. Indiana.
50. An inexpensive and convenient crib.
51. A mouse and rat proof crib.
52. A 130-bushel per acre crop of corn. Pennsylvania.

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